THE CLEAN ENVIRONMENT COMMISSION

Manitoba
Environment

MG 912

REPORT ON HEARING
VILLAGE OF ST CLAUDE SEWAGE LAGOON
AND DISCHARGE ROUTE

THE CLEAN ENVIRONMENT COMMISSION
July 1990

VILLAGE OF ST CLAUDE
SEWAGE LAGOON

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VILLAGE OF ST CLAUDE SEWAGE LAGOON

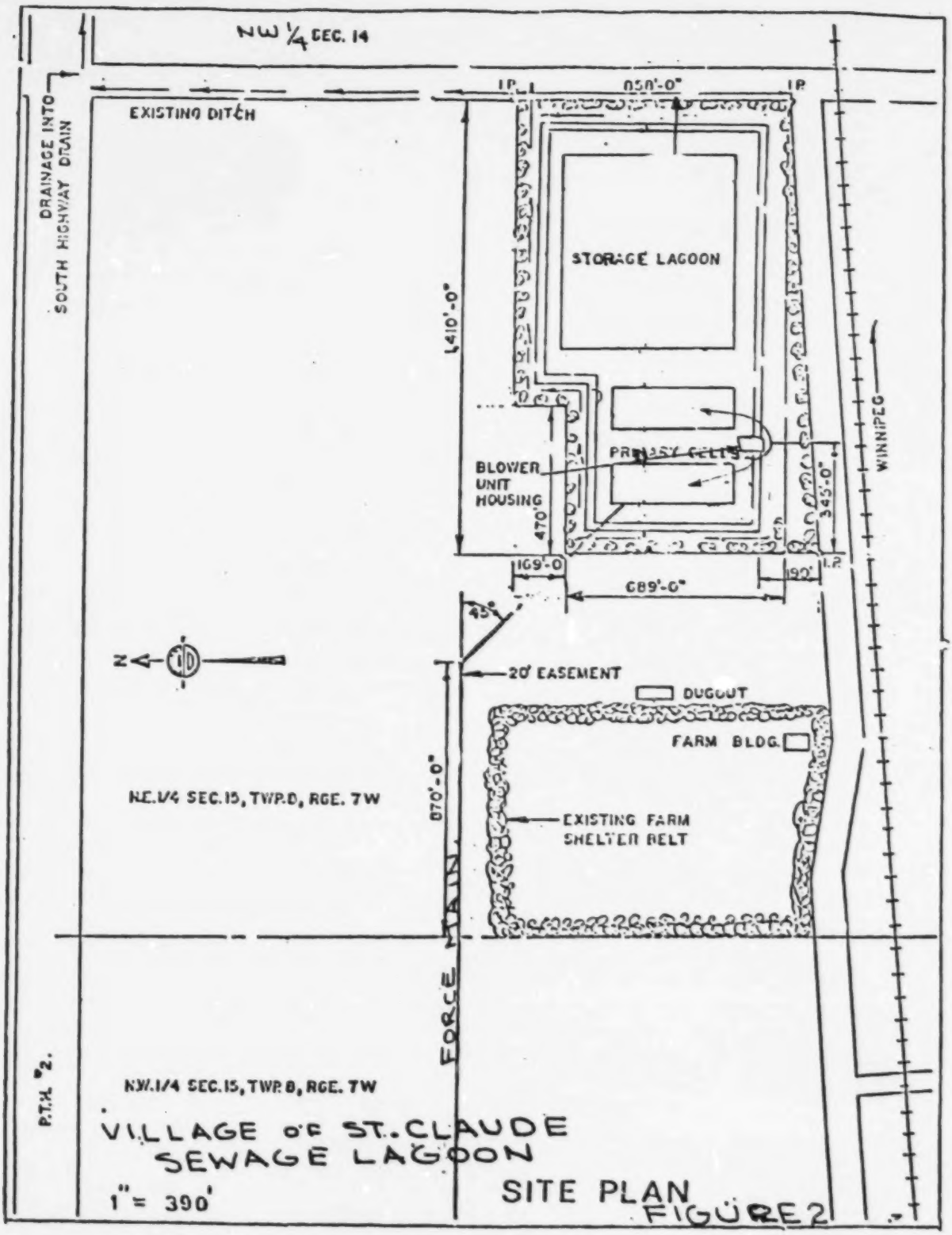
BACKGROUND

The sewage lagoon to service the Village of St. Claude (Figure 1) with a population of approximately 600 was placed in service in 1970. In addition to the sanitary wastes from the community, industrial wastes from a Modern Dairy Creamery (now Beatrice Foods Inc.) were also part of the waste load. To accommodate the organic loading from the industry, a 2 cell aerated lagoon system was constructed with an operating depth of 2.5 m followed by a storage cell (Figure 2). Discharge from the lagoon was to a municipal drain east of the lagoon which flowed north to the south drainage ditch of PTH #2. The highway ditch ultimately discharged to Elm Creek near Haywood (Haywood is approximately 10 km east of St. Claude on Highway 2).

The original "order" of The Clean Environment Commission (CEC), issued in November 1969, placed general limits on odor and groundwater contamination and specified the periods during which the lagoon effluent could be released. This "order" expired in 2 years time. Following re-application by the Village, a similar CEC "order" with a 5 year termination was issued in 1972.

In January 1979, a number of complaints were received concerning both odors and seepage from the lagoon facility. It was also established that it had only been necessary to discharge the lagoon once in the 8 years interval which was a strong indication that the permeability of the lagoon was not up to standard.

An assessment by the Environmental Management Division in 1979, recommended that the bottom and sides of the storage cell be lined with clay. It was generally understood that the primary cells had been clay lined initially.


NW 1/4 SEC. 14
EXISTING DITCH
DRAINAGE INTO SOUTH HIGHWAY DRAIN
I.P.
050'-0"
I.P.
STORAGE LAGOON
410'-0"
PRIMARY CELL
BLOWER UNIT HOUSING
470'
345'-0"
WINNIPEG
169'-0
689'-0"
192'
45°
N
20' EASEMENT
DUGOUT
FARM BLDG.
870'-0"
NE.1/4 SEC.15, TWP.8, RGE. 7W
EXISTING FARM SHELTER BELT
FORCE MAIN
P.T.H. #2.
NW.1/4 SEC.15, TWP.8, RGE. 7W
VILLAGE OF ST. CLAUDE
SEWAGE LAGOON
1" = 390'
SITE PLAN
FIGURE 2

VILLAGE OF ST. CLAUDE

W.1/2 SEC. 15; MOST N. 400' of N/W 1/4 SEC. 10;
MOST E. 400' OF SEC. 16 & MOST S. 225' OF S.W. 1/4 SEC. 22
TP. 8 — RGE. 7 W.

SCALE: 1 INCH = 800 FEET

REVISED: JUNE, 1980
OCT. 1981
DEC. 1981
MAR. 1987

PROVINCE OF MANITOBA
HIGHWAYS DEPARTMENT
DESIGN OFFICE
WINNIPEG, MAR. 1972

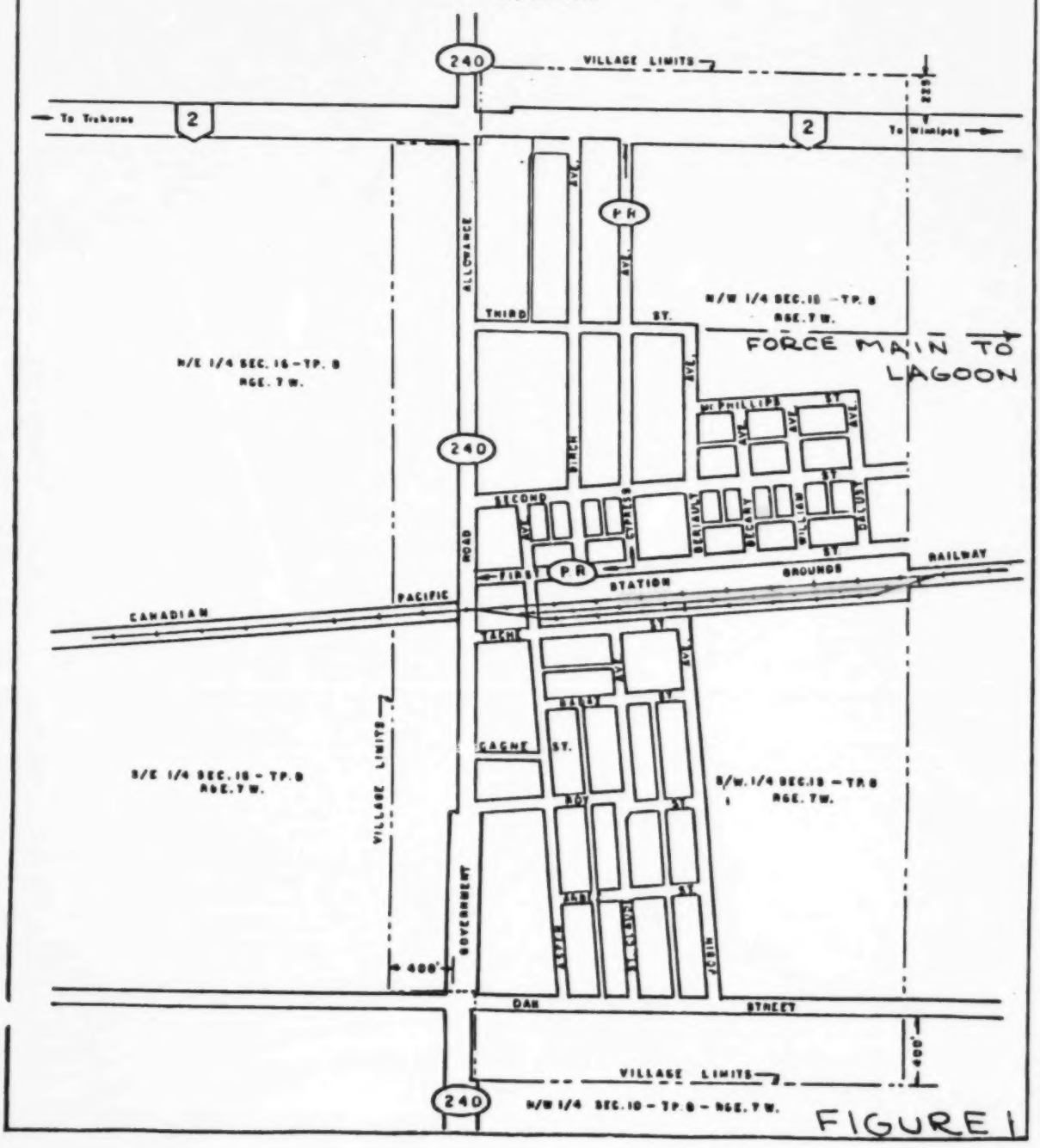


FIGURE 1

Background (Cont.)

A CEC hearing was held in March 1979 and the Commission subsequently ordered that the storage cell of the lagoon be rendered impermeable before May 1, 1981.

At the request of the Council of the Village, an estimate of projected costs of lining the cell was undertaken by the Village's municipal engineering consultant. Because of the prohibitively high estimated cost of lining the cell the Village applied to have the "order" varied.

At the hearing which was called to consider the latest developments in April 1980, the Village made an undertaking that as an alternative to lining the cell, an interceptor ditch would be constructed to collect seepage and that the storage cell would be discharged at the appropriate time and under appropriate conditions during both spring and fall, "both of the measures being for the purpose of minimizing the seepage from the lagoon system".

A varied order containing the foregoing stipulations was issued in May 1980.

There were both seepage and odour complaints from nearby residents during the period of the 80s.

Soil and ground water studies were done by the Environment Department in 1978 and a consultant, J. G Nielson, in 1988.

In January 1988, the Environment Department completed an engineering assessment which recommended that, in addition to reconstructing the lagoon cells, measures be taken to either reduce the sodium and chloride levels in the wastewater to concentrations that would meet the water quality objectives for irrigation water or that a discharge pipeline be constructed to a body of water capable of diluting the effluent to meet water quality objectives.

Background (Cont.)

In March, 1988, the Village replied that the variance proposed by the Environment Department would be prohibitively expensive and requested that a proposed CEC hearing to consider the matter be postponed until after July 1988.

On January 5th, 1989, the Village submitted a proposal pursuant to the Environment Act noting that the improvements expected in the lagoon operation and discharge route would be well beyond the financial capacity of the Village.

The Environment Department, in their analysis of the proposal, identified that the responses in the proposal form were deficient in information on seepage and salinity and measures to be implemented to mitigate the impacts. In June 1989, the Environment Department commissioned the Canada-Manitoba Soil Survey to undertake an extensive environmental impact study on lands in the area of the St. Claude sewage lagoon and along the effluent dicharge route. The results of this study were reported to the Environment Department in October, 1989.

On November 20, 1989, the Minister of Environment, the Honourable J. Glen Cummings requested that the Clean Environment Commission hold a public hearing concerning the continued operation of the Village of St. Claude sewage lagoon, including the recognition of environmental concerns that had been raised by adjoining property owners. The Village requested a delay in the hearing to provide time for them to evaluate the report prior to a hearing. The Clean Environment Commission gave notice of the hearing on April 2, 1990 and the hearing was held on April 17, 1990 in St. Claude, Manitoba.

Thirty people were in attendance at the hearing including the proponent, their legal counsel and consultants, representatives from the Manitoba Departments of Environment and Natural Resources, representatives of the Canada-Manitoba Soil Survey, and concerned residents.

The Commissioners in attendance were Mr. Maurice Blanchard, Acting Chairperson, Ms. E. Pawlicki and Mrs. J. Vestby. Commission legal counsel, Mr. D. Blevins, was also in attendance.

REPORT OF CANADA-MANITOBA SOIL SURVEY

W. Michalyna, a Pedologist, with the Canada Manitoba Soil Survey presented their report, "Environmental Impact Study on Lands in the Area of the St. Claude Wastewater Treatment Lagoon and Discharge Route", dated October 1989. The study on which the report was based was commissioned by the Environment Department and was undertaken during the summer of 1989.

The report stated that there is both a seepage and soil salinity problem adjacent to the lagoon and adjacent to the ditch which forms the discharge route for the effluent release. In some areas this is manifested by the surface ponding of liquid. The impact on crops is that the growth is retarded. No growth was observed in the area in closest proximity to the lagoon and the ditch. There was then a gradual change from no growth to regular growth as distance from the lagoon and drainage ditch increased. It was reported that this was similar to observations made by others on earlier occasions (Nielson in 1988; Environment Dept. in 1978).

The problem affecting the crop growth is a function of the presence of both sodium salts and water filled pores in the root zone of the soil. The sodium salt accompanies water involved in capillary action. The sodium effects the structure of the soil. The present study indicated that the lagoon seepage problem is in the portion of the soil column important to agriculture (1-1.5m) and that the impact is mainly in an area adjacent to the lagoon and along a portion of the discharge route.

Report of Canada-Manitoba Soil Survey (Cont.)

There was discussion concerning the soils in the area and their level of salinity. The surface soils to a depth of approximately 3m are sandy at the lagoon site. The sandy soil is underlain by clay. The salinity level of the soil is measured by the electrical conductivity of a paste mixture of soil and water. The normal conductivity of the surface soils in the area is 0.5 decisiemens per metre (dS/m). A value of less than 2 dS/m is considered as not affecting sensitive crops; a value less than 4 dS/m is considered as not effecting average crops. More saline areas had salinities that ranged to 11.1 dS/m.

A rather simple technique utilizing a conductance instrument was used to measure ground conductivity. Although the values registered on the conductance instrument are relative, in an area like the township in question, the readings become a guide to increasing or decreasing levels of salinity. The instrument can also differentiate between surface and subsurface conductivity (below 60 cm).

Conductance values were compared with conductivity values determined on a soil paste. Immediately west of the lagoon and east from the lagoon along the west boundary of the NW 1/4 of 14, surface conductivities were in the range of 9-9.5 dS/m. Subsurface values at 60 cms remained high at the western site but dropped off at the eastern site (salinity declined considerably with depth). In test holes further east (less than 200 m) conductivity values were normal. Earlier studies by Nielson and the Environment Department support the Soil Survey study. In addition, there were a number of sites - one north of the lagoon on the NE 1/4 15 and one south of PTH #2, on the NW 1/4 14 that had ground surface conductivity values slightly in excess of 9 dS/m.

The conductivity of the effluent had also been measured throughout recent years with values declining from a high of 12.8 dS/m in 1987 to a value of 2.2 dS/m in 1989.

Report of Canada-Manatoba Soil Survey (Cont.)

The water supply to the community, which is piped from a ground water source near Rathwell, Manitoba, has a conductivity of 0.7 dS/m. The two ions of concern, sodium and chloride are present at levels of 30 and 12.5 mg/L in the water supply.

A 1979 study by the Dept. of Environment revealed that the source of salinity in the waste water discharged to the lagoon resulted in large measure from deep wells, located in the shale formation, which were used by Modern Dairies Ltd. for rinsing trucks, etc. The use of these wells was discontinued in 1987, which could explain the almost ten fold reduction in the salinity of the wastewater (12.8 to 2.2 dS/m).

Conductance readings were taken at intervals of 0.1 Km in the NW 1/4 of Section 14 east from the lagoon. Readings were taken at 25, 50 and 100 m sections along the 0.1 km grid. These conductance values were sketched as iso-lines on a plot plan of the area in intervals of 10 from 40 to 90. There were values as high as 150 close in to the lagoon (Figure 3).

Chloride is also a good indicator of inorganic pollution. The line of demarcation selected for the chloride ion is taken to be 5 me/L. A sketch showing a plot of a 5 me/L iso-line was drawn. The iso-line for chloride shows that the influence of the saline water is on land adjacent to the lagoon and the drainage route.

Some additional work was undertaken on bulk density of soils, field moisture content, saturated water content and conductivity. A normal soil column, unaffected by the lagoon, was compared with site 5 (Figure 3), immediately east of the lagoon. The normal water table was at a depth of 1.35 m compared to site 5 at .85 m due to the ground water mounding from the lagoon. With the water table at the higher elevation, the capillary effect would result in soil saturation near the surface (within the root zone). Most crops require a certain percentage (at least 10%) of air freed pores to grow

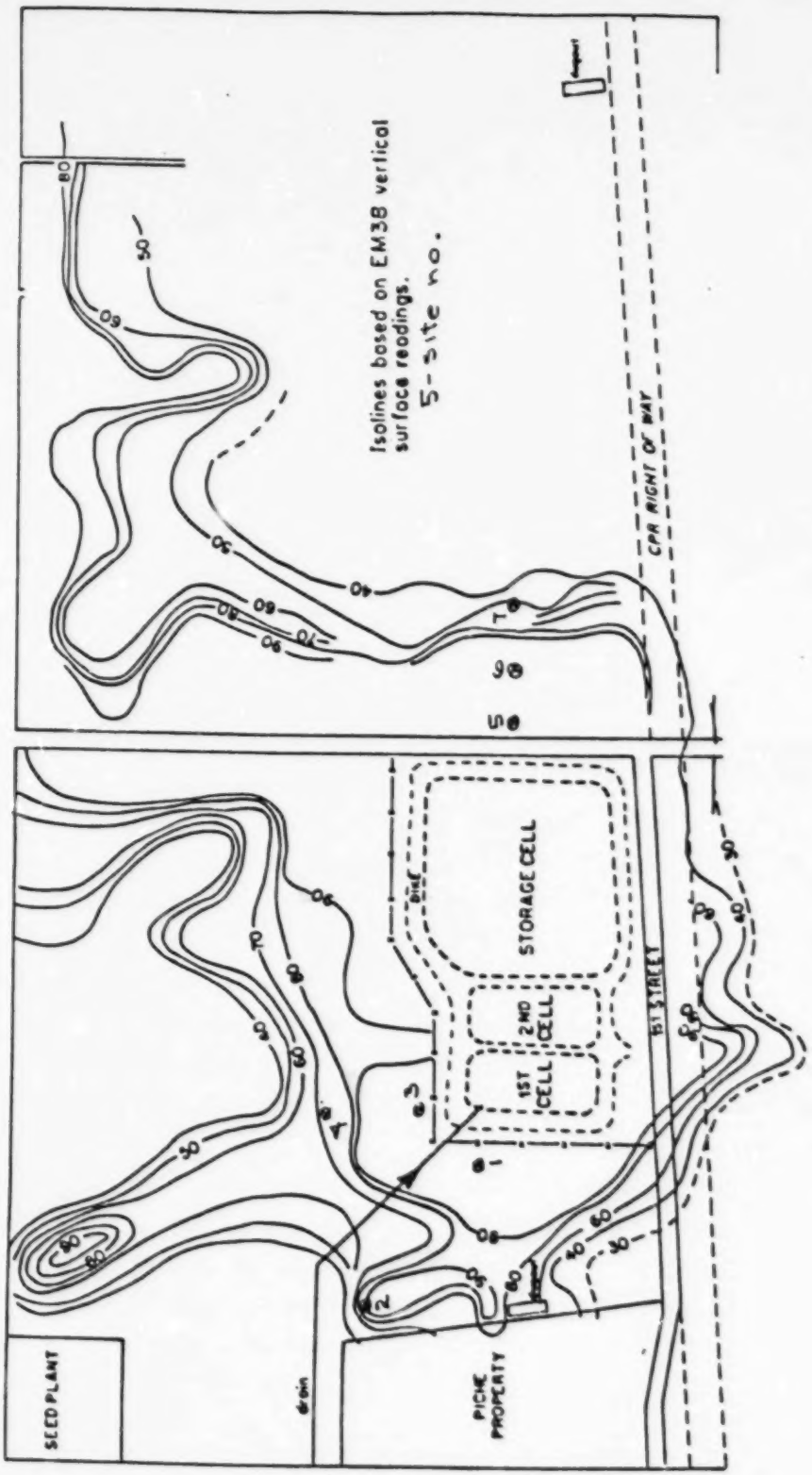


Figure 3 Isolines of Soil Conductance EM38-Vertical Orientation Measurements (average surface and subsoil conditions)

properly. Salts in the water can also be wicked up closer to the ground surface, which would adversely impact crop growth. The bulk density of soils, which would also impact crop growth, increases with increased amounts of sodium in the soil.

In summary, the effect of seepage in the area adjacent to the lagoon and the discharge route gives rise to a combination of factors that result in poorer crop growth.

The authors of the study prepared a map (Figure 4) which indicated the degree to which soil properties have been affected or altered by seepage. Strongly affected soils correspond with no crop growth.

The study team were asked to evaluate 5 possible situations in terms of future environmental impacts and report on possible remedial measures;

a) Continued Operation Without a Lagoon Liner and Without Elimination of all Possible Sources of Salinity from the Wastewater.

- The current operation of the lagoon would result in the continuation of seepage to the surrounding area but with less salinity than the historical values due to the discontinued use of deep wells serving the creamery. In proximity to the lagoon, the present effluent with reduced conductivity will replace the more highly mineralized water. The high water table could extend beyond the current boundaries. There would be minimal change to the area that is strongly affected (S). In terms of moderately affected soils (M), normal rainfall could possibly result in the transportation of the present salt to a lower level.

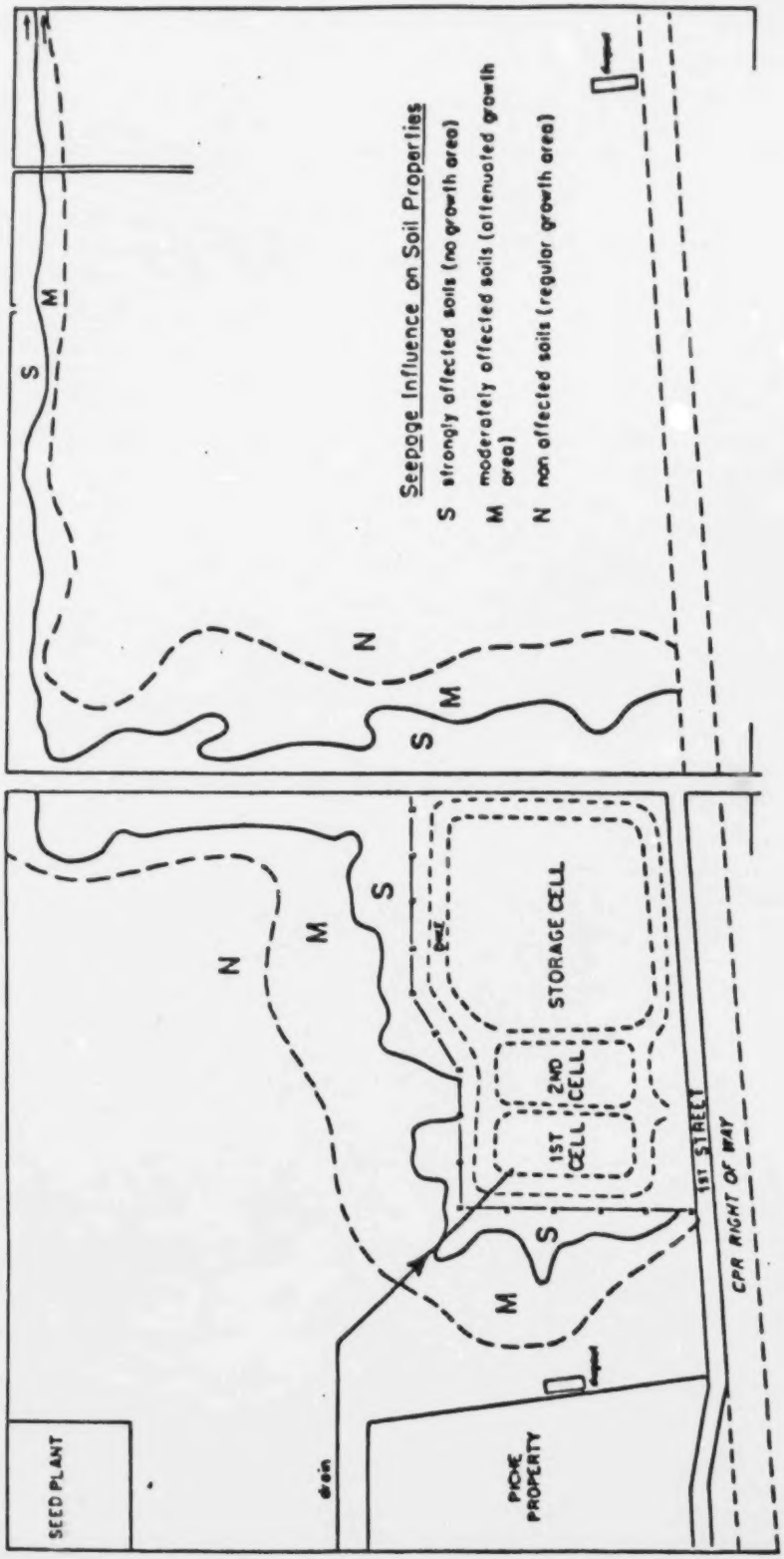


Figure 4 Extent of Strongly and Moderately Affected Soils by Seepage from the St. Claude Lagoon, NE 1/4 15 and NW 1/4 14 of Township 8-7W

b) Continued Operation of the Lagoon Without a Clay Liner and With Elimination of all Possible Sources of Salinity from the Wastewater.

- The continued operation of the lagoon without a liner and elimination of salinity sources would not change the condition for capillarity (problem of aeration in the root zone). The moderately affected areas would improve gradually as the present salts were conveyed to a lower depth. Near surface groundwater salinity would decrease in the vicinity of the lagoon as the low salt effluent moved through the soil. This could result in a slow expansion of the existing deeper saline groundwater zone.

c) Continued Operation of the Lagoon With a Clay Liner and Without Elimination of all Possible Sources of Salinity from the Wastewater.

- With clay lining of the lagoon and without elimination of salinity, the wastewater would be confined in the lagoon but would have to be discharged twice a year into the discharge route. The liner would result in a decrease of the water table in the surrounding area and improve the opportunity for greater aeration in the moderately affected soil area. A gradual decrease in salt level in this area would be expected. The impact on the strongly affected area would be expected to be minimal. Impacts would still occur along the discharge route and, in fact, the strongly affected area could increase.

d) Continued Operation of the Lagoon With a Clay Liner and With the Elimination of all Possible Sources of Salinity from the Wastewater.

- The installation of a clay liner and the operation of a program to reduce salinity would result in an immediate decrease in the

water table adjacent to the lagoon. During the fall discharge period particularly, seepage to adjacent lands would occur but the improved effluent quality would be beneficial.

With an improved effluent, in terms of an improved mineral quality, wastewater irrigation could be considered. It is conceivable that the strongly affected areas could be improved over a number of years by means of an engineered agronomic irrigation system (special crops, use of chemicals - such as calcium sulphate - and drainage considerations).

e) Discontinued Operation of the Lagoon.

- Discontinued operation of the lagoon would result in the ground water level adjusting to the regional situation. Areas of strongly affected soil would remain for some indefinite period. Areas of moderately affected soil would improve gradually as rainfall diluted and transported the present salt to a lower depth. Improvement in the strongly affected soil would require a deliberate program of irrigation, chemical amendments, drainage, and the growth of less sensitive crops (crops that can better resist the salinity and reduced porosity).

Mr. Michalyna was questioned about measures that could be taken to reduce the salinity of the wastewater. He pointed out that the conductivity of the wastewater had been reduced from an extreme of 12.8 dS/m in 1987 to 2.2 in 1989 as a result of the elimination of the deep brackish wells from the water supply system. This had also resulted in the sodium and sodium adsorption ratio (SAR) dropping significantly. The SAR in 1988 was 14.1. This compares to the municipal water supply which has a conductivity of 0.9

dS/m and an SAR value of less than 1. As a footnote, the Manitoba Water Surface Quality Objectives (Dec 1988) specifies an SAR of 8.0 for Category C, Field crop irrigation.

During cross examination, the Village's municipal engineering consultant pointed out that the sodium concentration in the effluent at present was 350 mg/L compared to a figure of 550 mg/L, which is the value used in the derivation of an SAR of 14. This more recent sodium value would result in a calculated SAR of less than 10.

Mr. Michalyna was questioned about the soil classification in the St. Claude area. He noted that the class was 3S. The designation "S" denotes a soil with a poor ability to hold water. As long as the water table is maintained at a high level, crop growth is maintained.

The Village's consultant also pointed out that within the area depicted as a "strongly affected soil" (Figure 4) there had been a crop taken off the past year.

Mr. Michalyna reported on the complexity of restoring the strongly affected soils that had been impacted by seepage. A completely different agricultural management program would be required which could include crop selection (legumes, grasses), drainage practises, chemical amendments and irrigation with high quality water.

Mr. Mike Van Den Bosch noted that, contrary to a remark by the Consultant, a seepage allowance was not identified in any previous licence of the Commission - nor would a licence authorize an allowable impact on adjoining lands.

Report of Canada-Manitoba Soil Survey (Cont.)

Mr. Lee, legal counsel for the Village, asked about salt-tolerant crops. Mr. Michalyna responded that barley, for example, would be more salt tolerant than alfalfa, although there would still be reductions in the yield of barley at higher salt concentrations. Wetness in the root zone, however, is not tolerated by any grass or cereal crop.

MANITOBA GOVERNMENT DEPARTMENT PRESENTATIONS

Mr. M. Rutulis, a groundwater geologist with the Water Resources Branch, reviewed the geology of the area. He pointed out that the aquifer is the surficial sand or silty sand layer. Since the surface layer is underlain by clay, vertical movement is prevented. Generally in shallow aquifers that are readily recharged from surface infiltration, chemical constituents such as sodium and chloride are quite low (20 to 100 mg/L). The bedrock in the area is shale but the water is salty.

Mr. Mike Van Den Bosch, an Environmental Engineer representing the Environment Department stated that an assessment of the St. Claude lagoon had been prepared by the Department in January, 1988. He noted that, due to the deficiencies in the proposal filed by the proponent in early 1989 with respect to the environmental impact of the lagoon effluent on adjoining properties, the Department had commissioned the "Environmental Impact Study on Lands in the Area of the St. Claude Wastewater Treatment Lagoon and Discharge Route" by the Canada Manitoba Soil Survey. In response to the question of lagoon leakage, Mr. Van Den Bosch emphasized the fact that the earlier Environment licences issued to St. Claude did not authorize seepage. He pointed out that the municipal owners of a facility that had a similar problem years ago (excessive seepage to the detriment of nearby property) had been unsuccessful in using that defence in a civil law suit.

Manitoba Gov't Dept. Presentations (Cont.)

In response to a question as to whether the lagoon was in violation of the licence he stated that, from an odor perspective, the aeration equipment had been breaking down at too frequent intervals. This had caused discomfort to people and if the system cannot be made to function adequately, the equipment should be replaced. With regard to the seepage problem - based on the report of the study by the "Soil Survey" - clause 1 (b) of the current licence, (stipulating that "the said sewage lagoon is operated in such a manner that the disruption of conditions in adjacent soil layers is prevented"), is no longer being met.

The Clean Environment Commission licence 827 dated April 19, 1979 required that the storage cell of the lagoon be made impervious so that disruption of adjacent soil layers would be prevented. The Village applied for and received a variance to the clause in May 1980. In its place, the Village agreed to construct an interception ditch and to dewater the storage cell twice a year. The facility was to be monitored and the results reviewed within a 2 year period. Presumably, this current process was the review identified in the 1980 CEC order. (As a footnote to the matter of the lining of the storage cell prescribed in April, 1979, testimony of that hearing revealed that the 2 primary cells had been lined with clay during the initial construction).

Following Mr. Van Den Bosch's comments, there was a general discussion of the recommendations that were a part of the Soil Survey assessment report.

One of the recommendations dealt with the reduction or elimination of salt from the wastewater. The possibility of examining alternatives to

household zeolite softeners was raised. Sodium chloride is utilized as a regenerant which adds this salt to the wastewater system and hence to the lagoon. If softening is considered essential (and the Mayor agreed that one half of the residents employed household softeners) softening by some other method could be considered at the water supply source.

Mr. Lee, Legal counsel for the Village, questioned Mr. Van Den Bosch as to the origin of the sodium and chloride limit of 30 and 68 mg/L recommended in his assessment. Mr. Van Den Bosch said that the sodium value proposed is the current level in the municipal water supply whereas the chloride is the water quality objective for an irrigation water supply. The low values were chosen to meet the needs of a crop growing adjacent to a lagoon where the land is subject to a perched water table and capillary action.

In response to another question, Mr. Van Den Bosch maintained that there would be an insignificant increase of sodium to wastewater from human excretion.

Mr. Lee proposed that body wastes would increase the sodium by as much as 50 mg/L which would than bring the total sodium level to 80 mg/L (no literature citation was given).

The possibility of lining the cells was questioned. How would the system be operated during construction? Mr. Van Den Bosch offered the opinion that there would be a suitable engineering response to this matter upon appropriate study and consideration. He was not able to offer any information on the cost of a program to implement the recommendations. The Village consultant introduced testimony that, aside from an aeration equipment retrofit, a lagoon liner and force main are estimated to cost $2,700,000. Of that amount, the liner would be estimated to cost 600,00 to $1,000,000.

Manitoba Gov't Dept. Presentations (Cont.)

Mr Van Den Bosch was further questioned about the value of the loss in crop production on the impacted agricultural land (Mr. Michalyna later reported that the area of strongly and moderately affected soil in the NW 1//4 14 and the NE 1/4 15, was 25 hectares). In his view, the relevant fact was not the amount of loss but whether there is an impact on the land. It was his understanding that the affected landowners were seeking compensation; however, the Environment Licence should have requirements put in place to protect those lands from adverse environmental impacts.

Mr. Lee questioned Mr. Van Den Bosch about the preferred alternative in the "Soil Survey Report". He felt that it was essential to protect adjoining lands and that the lagoon lining and salt minimization would make the most sense without taking into consideration monetary costs. In his view, economic costs should be considered but the mere weighing of costs, if the rights of others are being impacted, is not acceptable.

THE VILLAGE OF ST. CLAUDE

Ms. Dupasquier, Secretary-Treasurer of the Village of St. Claude, introducing the presentation of the Village, stated that the municipal expenditure for 1989, including education, was around $475,000 (the appropriate financial information was later forwarded to the Commission from Mr. Lee).

Mr. Ewing, a Consulting Engineer with M.M. Dillon Ltd. acting on behalf of the Village, spoke next. The study undertaken by the Consultant determined that the cost to line the lagoon and construct a pipeline to the Assinboine River, a distance of 20 km would be $2,700,000. He pointed out

that measures taken to reduce the salinity of the wastewater had resulted in a sodium reduction from a level of approximately 1400 mg/L to 350 mg/l (in subsequent correspondence Mr. Lee reported that an even more recent analysis of effluent sodium content was 209 mg/L). In the view of the consultant, the Village are approaching the point of eliminating all possible sources of salinity from the wastewater.

Mr. Ewing noted that the installation of a clay liner would have the effect of dropping the water table adjacent to the lagoon somewhat. This would improve the aeration of the moderately effected soil and a gradual decrease in salinity would occur in that soil. It would have little impact on the strongly affected soils. The soils adjacent to the drainage route would not continue to be affected, due to the reduced salinity. The effluent at the current level of salinity could be used as a source of irrigation water to dilute the salts in both the strongly and moderately affected soils.

Mr. Ewing outlined a series of possibilities concerning the ground water quality, quantity and movement. A suggestion was made that Modern Dairies might examine the use of non sodium based cleaners. He also conjectured that the salinity in the soil near the lagoon and discharge route might be due to other uninvestigated causes such as highway de-icing, farm fertilizer practices, or salt intrusion from deeper aquifers.

The Consultant felt that the sodium level could be reduced down into the range of 200-250 mg/L (a sodium analysis based on a sample collected on April 19, 1990 was at a level of 209 mg/L). The sodium absorption ratio has evidently thus been reduced from 14.1 (reported by Michalyna as 1988 data) to 9.2 as reported by the Consultant at the hearing. Based on a sample collected April 19, and reported to the Commission by correspondence under date of May 1, 1990 the effluent would now have an SAR level of 5.4.

The Village of St. Claude (Cont.)

Based on these foregoing salt reductions, the Consultant felt that seepage water from an unlined lagoon would not be unacceptable in the shallow aquifer. Lagoon effluent with its improved salinity could be used for irrigation.

The Consultant concluded his presentation by recommending that the Village be permitted to target a sodium level of 350 mg/L in the effluent and that a program be undertaken to reduce the use of excessive salt in regenerating household softeners. Beatrice Foods would be encouraged to examine the use of alternative non-sodium washing solutions. There would also be a commitment to clean and upgrade the drainage route. The Village would also make an undertaking to conduct soil studies to determine the effectiveness of these programs. In the longer term, if there are not improvements, more strenuous measures, such as a ban on household softeners and the use of sodium based washing solutions at the creamery, might have to be undertaken.

In response to a question about drainage to improve the high water table problem, Mr. Van Den Bosch pointed out that the Village had undertaken the interception of seepage from the lagoon ten years ago, without success.

CITIZEN STATEMENTS

Mr. R. Laurent, a citizen located several hundred metres south east of the lagoon, drew attention to a serious concern that he had with respect to odors from the facility. From the outset, he had expressed concern about the proximity of the lagoons to his dwelling. He was informed that the lagoons would not smell. The odor is most severe at spring break-up but it also smells at other times throughout the year. In response, Mr. Van Den Bosch noted that since the lagoon system was not a simple facultative lagoon but was mechanically aerated, the normal criteria of 300+ metres distance between a

residence and a lagoon did not apply. He went on to add that aeration system breakdowns at St. Claude are quite routine. Air is also not being distributed evenly and it is therefore not effective. Mr. Laurent felt that it had taken too long to fix the system.

Mrs. Philippot, one of two landowners whose property has been affected by seepage, informed the hearing that the same matters were dealt with 10 years before and the situation has worsened since. The growth of any crop (rape seed, wheat, buck wheat) is affected on the impacted area of her property.

DISCUSSION

The major adverse impact from the Village of St. Claude sewage lagoon operation and the discharge of effluent to the drainage route is one of seepage of effluent to adjoining lands. The chemical quality of that effluent has ranged from saline (approximately 1% salinity) to what one might consider a normal effluent for a southern Manitoba community.

History of the Lagoon Construction and Operation

When the water and wastewater system was constructed in the late 1960s, seepage rates from other municipal lagoons, equivalent to the system at St. Claude, were not uncommon. It was soon recognized, however, that excessive seepage from a lagoon could result in damage to adjoining agricultural lands and groundwater aquifers. In less than a decade of operation at St. Claude, there were complaints, of soil and crop damage from seepage, from residents located adjacent to the lagoon and effluent discharge route.

Discussion (Cont.)

An environmental report, which included a soil study undertaken by the Environment Department in 1978, concluded that seepage was occurring at the St. Claude lagoon. The report stated that the degree of seepage was such that an area east and north of the lagoon was being affected and this had generated complaints.

Included in that study was a laboratory analysis of the hydraulic conductivity (permeability) of the soil that would likely have been the material from which the sides and bottom of the lagoon were constructed. The hydraulic conductivity was in the range of 10^{-5} cm/sec. The current departmental sewage lagoon construction guideline specifies a clay material with an hydraulic conductivity of 1×10^{-7} cm/sec , for the sides and bottom of lagoons (this is a much more impervious material than the St. Claude soil). The excessive permeability of the lagoon at St. Claude is also borne out by the fact that for the first 8 years of operation (until 1978) there was no discharge from the facility. It was only in 1978 that the contents of the storage cell had to be released into the local drain although the storage cell had been designed with an outlet to release stored effluent.

The Commission held a hearing in St. Claude in March, 1979 to consider the seepage and odor complaints. Following this hearing, the Commission ordered the Village to render the storage cell impermeable in order to prevent contamination of groundwater and adverse impact of adjacent soil layers. The lagoon liner was ordered to be installed within 2 years. There were also stipulated conditions related to the presence of dissolved oxygen in the primary cell and the loading of these cells, as well as limits specified for the quality of discharged effluent and the timing of effluent release. The order dealt with lining of the storage cell only since the Village identified that the primary cells had been clay lined at the time of construction.

Discussion (Cont.)

Early in 1980, the Village requested a variance of the CEC order to delete the clause relating to permeability.

On receipt of a report from the Village in March 1980, the Commission held a hearing to consider the variation request. In its presentation, the Village pointed out that the lagoon lining would be excessively costly and that as an alternative they proposed to construct interceptor drains adjacent to the lagoon and they also agreed to drain the storage cell in both spring and fall to reduce the level and hence seepage from the lagoon.

In May 1980, a new licence was issued by the Commission that omitted the lagoon lining clause but instructed that the order be reviewed in 2 years to determine the degree of success achieved by the Applicant in minimizing the seepage of the lagoon contents.

A formal review as prescribed by the order did not take place; however, complaints of seepage and odours continued. At the request of the Environment Department, the Village were asked to file a proposal under the Environment Act for the continued operation of the lagoon. This proposal was filed in January 1989. Because of some deficiencies in the proposal concerning the impacts of seepage on lands adjoining the lagoon, the Department commissioned the study by the Canada-Manitoba Soil Survey presented at the current hearing.

The Canada-Manitoba Soil Survey Report

This report confirmed that the lagoon was leaking and that there was an effect from the leakage on adjoining land. The impact was due to both a capillary effect, which filled the soil pores in the root zone with moisture

in excess of that needed for aeration, and a build-up of salinity in this zone, which also had an impact on crop growth. Information on salt concentrations, moisture content and soil bulk density was analyzed in order to determine the influence of both seepage from the lagoon and the effluent drainage ditch. This information was consolidated onto a sketch which included the NW 1/4 of 14 and the NE 1/4 of 15. Boundary lines were drawn which indicated areas that were strongly affected by seepage (no growth) and moderately affected soils. The study showed that 25 hectares are affected by the seepage.

The study observed that without the addition of a lagoon liner and elimination of all possible sources of salinity from the wastewater, the effect would continue to spread beyond the present area of the strongly affected soil.

The elimination of all possible sources of salinity, without a clay liner, would result in a minimal change to the strongly affected areas. Areas of moderately affected soil would improve gradually upon rainfall dilution and transport of the salt build-up to a lower depth.

A clay liner, without elimination of salts, would result in a decrease in the water table closer to the lagoon. The capillary effect would be lowered in the moderately affected areas with an opportunity for greater aeration and with an expectation of a decrease in salt level. Strongly affected soils would be changed minimally. Since more effluent would reach the drainage route, an expansion of the strongly affected areas adjacent to this network could occur.

The continued operation of the lagoon with a liner and with the elimination of all possible sources of salinity from the wastewater would

result in a decrease in the water table of the adjacent affected land. This would result in an opportunity for greater aeration in the area of moderately affected soil. The improved quality of the effluent could serve as a diluent for both the strongly and moderately affected soil groups. The low SAR effluent could be used for irrigation of crops. Attempts at remediation of strongly affected areas could be undertaken with this effluent.

At an earlier stage before the coming into effect of the new Environment Act, the Environment Department had prepared an environmental report on the situation at St. Claude. Several recommendations were made that would have serious financial implications for the Village - that either sodium chloride be reduced to effluent levels of 30 mg/L (sodium) and 68 mg/L (chloride) or that a pipeline be constructed to the Assiniboine River. It also recommended that the lagoon system should be lined. The hearing was told by the representative of the Environment Department that these recommendations did not take economic considerations into account. In the view of the Department representative, the relevant fact was not the amount of loss to nearby property but whether there is an adverse impact on the land from seepage.

Odor Problems

There were also concerns respecting odours from the lagoon facility. In addition to domestic wastewater from 600 residents, the lagoon system must handle some of the industrial waste from a Beatrice Foods Creamery. The waste from industry is high in organic matter (high BOD) and rather than using a facultative primary treatment cell with a large area (an estimated 6 hectares required) 2 smaller primary cells with an area of 1.5 hectares were used. The 2 primary cells were designed as aerated lagoons with a depth of 2.5 m. Mechanical equipment (air blowers and a diffused system of aeration) is

therefore needed both to meet organic discharge limits and to prevent the creation of odors. The system apparently fails on occasion to add sufficient air to the liquid or to add air efficiently.

Intervenors at the hearing reported that odors could occur at any time of the year. The Department representative indicated that the lagoon aeration system malfunctioned with too great frequency. Either a failed blower unit or plugged diffusers or broken air lines could result in poor or no dissolved oxygen which could result in odor production. In this regard, the villages consultant did not appear to have a real awareness of problems with the aeration system used for biological enhancement in the primary lagoons.

Cost of Remedial Action

The Village drew attention to the cost of the remediation program that had been identified. A liner and pipeline to the Assiniboine River would cost $2,700,000 of which the liner would represent $600,000 to 1,000,000. The Consultant noted that the Village had gone a long way towards the practical elimination of salt from the wastewater. The use of a deep well by the Creamery, which water contained high concentrations of salt, had been eliminated from the wastewater system. Sodium in the wastewater had declined from a value of 1350 mg/L in the late 70s to a value of 350 mg/L based on a sample collected just prior to the hearing. A sample taken following the hearing was at a concentration of 209 mg/L. The Consultant also pointed out the difficulty of meeting the recommended limit of the Department of 30 mg/L of sodium since the water supply itself contained 20-30 mg/L in addition to human excretions and brine wastes from softening.

Discussion (Cont.)

The Consultant expressed the opinion that seepage water of the present quality from an unlined lagoon would not be unacceptable in the shallow aquifer. The salts in the moderately affected soil areas would be subject to reduction by dilution. The effluent could be used for irrigation of crops. The effluent might even be used in a program to improve the strongly affected soil areas.

The real concern of the Village is the cost of any renovation to the lagoon and discharge system. The Secretary Treasurer pointed out that the total expenditure for the Village for the 1989 fiscal year excluding Education Foundation and special levy amounted to approximately $302,000.

Intervenor Concerns

The intervenors, Mrs. Piche and Mrs. Philippot, were both present at the hearing but provided little testimony. Mrs. Philippot indicated that she had gone through this same process 10 years previously when only a small parcel of her land was damaged. She noted that throughout the years a variety of crops have been sown and nothing has grown in the affected areas.

CONCLUSIONS

The Commission concludes that seepage of a brackish to saline wastewater effluent has been taking place from the sewage lagoon and effluent drainage route of the Village of St. Claude. It further concludes that the seepage has resulted in soil and crop damage to lands adjacent to the lagoon and discharge route.

Conclusions (Cont.)

The Commission heard that there has been a major reduction in the concentration of salinity in the effluent in the past several years. A number of additional sources of sodium salts have been identified in the wastewater such as cleaners used at the Beatrice Foods operation and regenerants from individual household softeners. The Commission concludes, however, that it is necessary to further reduce sodium concentration from the 200-300 mg/L range. A measure of the sodium level necessary to prevent further land degradation and even improve nearby soil conditions would have to be demonstrated by soil testing.

The Commission further concludes that a complete or partial failure of the aeration system in the primary cells of the lagoon results in the production of objectionable odors that impact the comfort of neighboring residents.

The Commission also heard evidence that part of the difficulty associated with soil degradation adjacent to the discharge route was associated with poor surface drainage. It is believed that this matter has been explored in the past but the Commission concludes that the Village should explore the lagoon drainage route and take whatever measures are possible to improve drainage and thus reduce seepage impacts.

RECOMMENDATIONS

The Commission recommends:

1. The Applicant shall ensure that:

   (a) on or before the 1st day of August 1, 1992 the Village of St. Claude sewage lagoon cells are rendered impermeable to the degree necessary to ensure compliance with the limits prescribed in Clause 2 of this Order;

Recommendations (Cont.)

(b) on or before the 1st day of November, 1990, a proposal is filed with the Environmental Management Division of the Department of Environment detailing the Applicant's plans to achieve compliance with Clause 1(a) of this Order.

2. The Applicant shall ensure that the said sewage lagoon cells are maintained and operated in such a manner that:

(a) the contamination of groundwater is prevented;

(b) the disruption of conditions in soil adjacent to the lagoon cells is prevented;

(c) a minimum of 3 milligrams of dissolved oxygen per litre is detectable at all times in the top 2.5 meters (5 feet) of the liquid in the aerated cells, for the purpose of minimizing the release of offensive odours, with sampling and reporting to be undertaken as specified by the "Director" of the Environment Department;

(d) the organic loading on the said sewage lagoon system, in terms of the five-day biochemical oxygen demand, is not in excess of 355 kilograms (784 pounds) per day with sampling and reporting to be undertaken as specified by the Director;

(e) there is no discharge of effluent from the said system between the 1st day of November of each year and the 15th day of May of the following year;

(f) the quality of the effluent from the said sewage lagoon system, prior to discharge, is such that:

Recommendations (Cont.)

(i) the organic content of the effluent, in terms of five-day biochemical oxygen demand, is not in excess of 30 milligrams per litre of sample;

(ii) the fecal coliform content of the effluent as indicated by the M.P.N. Index, is not in excess of 200 per 100 millilitres of sample.

3. The Applicant shall ensure that there is no discharge of water into the wastewater lagoon system from deep wells drawing water from the underlying shale aquifer.

4. The applicant shall ensure that the following investigations are undertaken to the satisfaction of the Director:

(a) soil testing adjacent to the lagoon and along the discharge route to ensure that following the practical elimination of salinity from the wastewater and the placement of lagoon lining, no further land is affected by seepage from the lagoon or along the discharge route;

(b) testing of the chemical characteristics of the wastewater for the purpose of assuring that no additional sodium sources of wastewater are added and that a further reduction of sodium is effected, if necessary;

(c) complete examination of the aeration equipment in the primary lagoon cells and correction of any detected deficiencies;

Recommendations (Cont.)

(d) studies (which would have to be done collaboratively with the Highways Department) to evaluate the condition and gradient of the drainage route and undertakings to lessen the residence time in the drainage system by means of cleaning and regrading the drains to the extent practicable.

LIST OF EXHIBITS
&
PRESENTATIONS

1. Hon. J. Glen Cummings, Minister of Manitoba Environment, Letter, (dated November 20, 1989), read into the record by the Chairman.

2. Walter Michalyna, Canada-Manitoba Soil Survey, Environmental Impact Study & Slides.

2.A. James G. Nielson Report.

3. Central Mortgage & Housing Corporation Letter (dated December 3, 1969) from L.A. Kay, Director, Environmental Sanitation.

4. Regis Laurent, resident of the Village of St. Claude, verbal presentation.

5. Maris Rutulis, Aquifer Data Geologist, Water Management, Manitoba Natural Resources, verbal presentation.

6. Mike Van Den Bosch, Environmental Engineer, Manitoba Environment, verbal presentation.

7. John Ewing, Senior Environmental Engineer, M.M. Dillon, brief.